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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 639

Joint Contribution from the Bureau of Animal Industry, JOHN R. MOHLER, Chief and the Bureau of Markets, CHARLES J. BRAND, Chief

Washington, D. C. ▼ February 15, 1918

THE MARKET MILK BUSINESS OF DETROIT, MICH., IN 1915

By

CLARENCE E. CLEMENT, Dairy Division, Bureau of Animal Industry and GUSTAV P. WARBER, Bureau of Markets

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ECONOMIC PHASES OF THE MARKET MILK BUSINESS.

Preliminary studies by the Department of Agriculture have shown the existence of many uneconomical practices in the market milk business. These practices have been largely the result of the rapid changes that the business has undergone in recent years. Constantly increasing demands for market milk in the larger cities of this country have resulted in such a rapid increase in the business of "middlemen" or dealers that many fundamentally uneconomic marketing practices have developed and wasteful leaks have been allowed to occur daily. In short, efficiency systems have not kept pace with the growth and development of the business.

NOTE.—This bulletin should be of interest to milk dealers, city and State milk-inspection officials, consumers' leagues, producers' organizations, and students of the subject of market milk.

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In the present study[1] is presented a general analysis of the market milk business as conducted in Detroit, Mich., during the year 1915, with a view of indicating some of the fundamental explanations of existing market conditions and milk marketing practices in the larger American cities. The cost of milk, wages, and many items of expense have increased greatly since the data were obtained, and for that reason no attempt has been made to show absolute cost and profit figures. Some cost analyses are presented, however, in a way that will point out fundamental tendencies not dependent upon transitory changes in prices and which help to explain some of the prevailing market practices.

The city of Detroit, Mich., was selected for the study primarily because in many respects milk marketing methods in that city are representative of those in other large cities of the United States. Since the pasteurization of market milk had been made compulsory by ordinance in Detroit three months before the investigations were begun, the selection of that city also permitted a study of the effects of compulsory pasteurization upon the number of dealers engaged in the business and upon the methods of handling and distributing milk.

MARKET DEMANDS AND SOURCES OF SUPPLY.

The average quantity of market milk consumed daily in Detroit during August, 1915, was approximately 47,569 gallons, and of market cream 5,953 gallons. Based upon an estimated population of 600,000 this would provide approximately 0.63 of a pint of milk and 0.08 of a pint of cream per capita daily. The consumption is not uniform throughout the year, however. The shipments of milk during May and June were the highest of the year, but the receipts were in excess of the city consumption during those months.

According to the records of one of the largest dealers, the market demand for milk in per cent of the yearly consumption is shown below by seasons:

	Per cent of total.
Spring	26.7
Summer	30.2
Fall	20.9
Winter	22.2
	100

It will be noted that the consumption during the summer months was one-half higher than during the fall months.

[1] Most of the data upon which this study is based were collected during September and October, 1915. Figures of total quantities of milk handled and general information concerning the nature of the business of all the dealers were obtained from the records of transportation companies and the files of the milk-inspection department of the Detroit board of health. The cost analyses were based upon the records of certain typical dealers.

Figure 1 shows the area from which the supply of milk and cream was obtained, each dot representing one 10-gallon can of milk or cream. The small squares show the location of country milk stations where milk was collected, weighed, and cooled before it was transported to the city pasteurizing and bottling plants. The figure

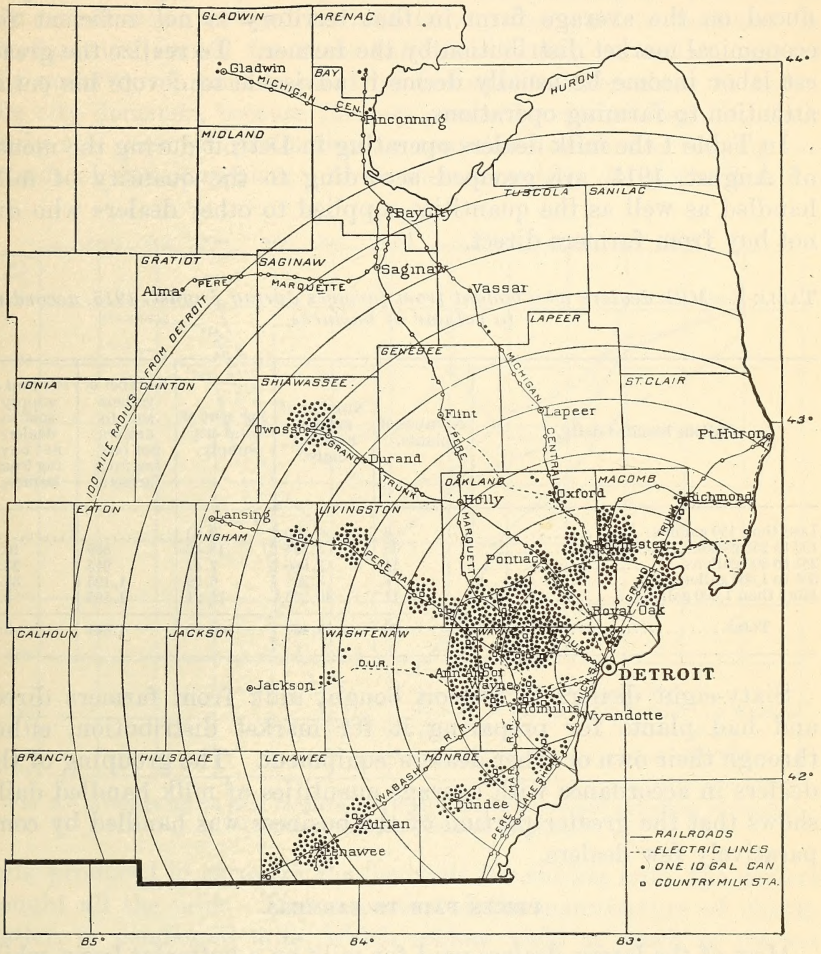

FIG. 1.—Sources of milk and cream supply of Detroit, and the steam and electric railways over which most of it is transported to the city.

shows that the greater part of Detroit's supply of milk was produced within 30 miles of the center of the city. Some shipments of cream originated in zones 100 miles distant or more. Because of the stringent regulations of the board of health in regard to city dairies, the quantity of milk produced within the city was negligible.

BUYING MILK FROM FARMERS.

Figure 1 also shows the necessity for middlemen to handle and distribute the greater part of the city's supply. Farmers living more than 6 or 8 miles from town generally considered it impracticable to deliver their milk to the consumers. The quantity of milk produced on the average farm in that territory is not sufficient for economical market distribution by the farmer. To realize the greatest labor income he usually deems it advisable to devote his entire attention to farming operations.

In Table I the milk dealers operating in Detroit during the month of August, 1915, are grouped according to the quantity of milk handled as well as the quantities supplied to other dealers who did not buy from farmers direct.

TABLE I.—*Milk dealers who bought from farmers during August, 1915, according to volume of business.*

Gallons handled daily.	Number of plants.	Number of gallons handled daily.	Per cent of total city supply.	Number of gallons sold to dealers not buying from farmers.	Per cent of supply sold to dealers not buying from farmers.
Less than 150 gallons	6	336	0.63	.....	.....
150 to 250 gallons	35	5,594	10.46	569	10.17
251 to 500 gallons	11	3,960	7.41	915	23.11
501 to 1,000 gallons	5	3,365	6.29	1,195	35.51
More than 1,000 gallons	11	40,205	75.21	2,165	5.38
Total	68	53,460	100.00	4,844	9.06

Sixty-eight dealers in Detroit bought milk from farmers direct and had plants for preparing it for market distribution, either through their own or other dealers' equipment. The grouping of the dealers in accordance with average quantities of milk handled daily shows that the greater portion of the business was handled by comparatively few dealers.

PRICES PAID TO FARMERS.

Most of the larger dealers paid for milk on a butterfat basis, while the majority of smaller ones bought their milk by weight or measure without allowing premiums or making deductions based on butterfat content, sediment test, bacterial content, or the score of the dairy farm on which it was produced. The larger companies usually based their monthly price quotations to farmers upon a butterfat test of 3.5 per cent. For each one-tenth of 1 per cent butterfat the milk tested below 3.5 per cent the price was reduced 2 cents a hun-

dredweight. For milk testing more than 3.7 per cent a premium of 2 cents for each one-tenth of 1 per cent butterfat was paid. When compared upon a common basis the prices actually paid by the various dealers were found to vary considerably.

Figure 2 shows the average prices (f. o. b. Detroit) paid by milk dealers handling different quantities of milk during 1915, as well as the rather wide seasonal variations in prices paid to farmers. A fundamental reason for these variations is that at certain seasons the quantity of milk supplied by farmers is either above or below the city demands, because farmers generally can not regulate their daily and seasonal production in accordance with the varying demands of city consumers. As farmers generally did not utilize the

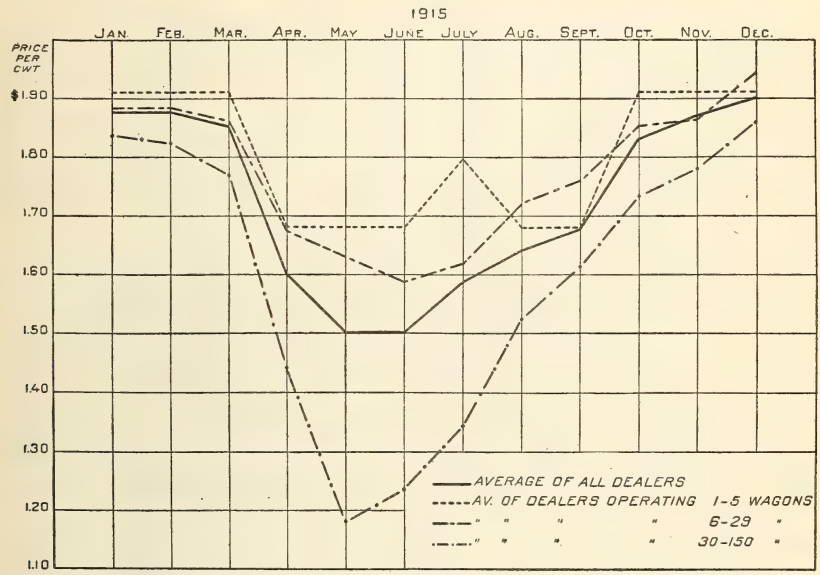

FIG. 2.—Average prices paid farmers by all milk dealers, grouped according to number of delivery wagons operated by each.

milk produced in excess of the demands for market milk, the dealers bought all the milk. That necessitated the manufacture of cheese, butter, or condensed milk, which seldom yield as much as market milk. Some of the dealers who had no facilities for the economical disposal of skim milk actually dumped it into the sewers.

The prices paid by the larger dealers fluctuated more than those paid by the smaller ones. The latter also usually paid the highest prices for their milk, which is explained in part by the fact that the former obtained their supplies from localities farther from the city, where competition for market milk was not so keen, and where increased costs of transportation tended to reduce the prices paid to the farmer as is shown in Table II.

TABLE II.—*Transportation costs in relation to farmers' prices.*

Shipping station number.	Freight or trucking cost per 10-gallon can to Detroit.	Farm prices per 10-gallon can to Detroit.	Cost to dealer f. o. b. Detroit.	Shipping station number.	Freight or trucking cost per 10-gallon can to Detroit.	Farm prices per 10-gallon can to Detroit.	Cost to dealer f. o. b. Detroit.
1	$0.15	$1.53	$1.68	7	$0.20	$1.53	$1.73
2	.15	1.49	1.64	8	.22	1.42	1.64
3	.15	1.53	1.68	9	.23	1.42	1.65
4	.175	1.53	1.705	10	.24	1.36	1.60
5	.175	1.42	1.595	11	.28	1.28	1.56
6	.175	1.53	1.705	12	.30	1.23	1.53

This table shows that although there was a tendency to pay less for milk or cream as the distance and cost of transportation increased,

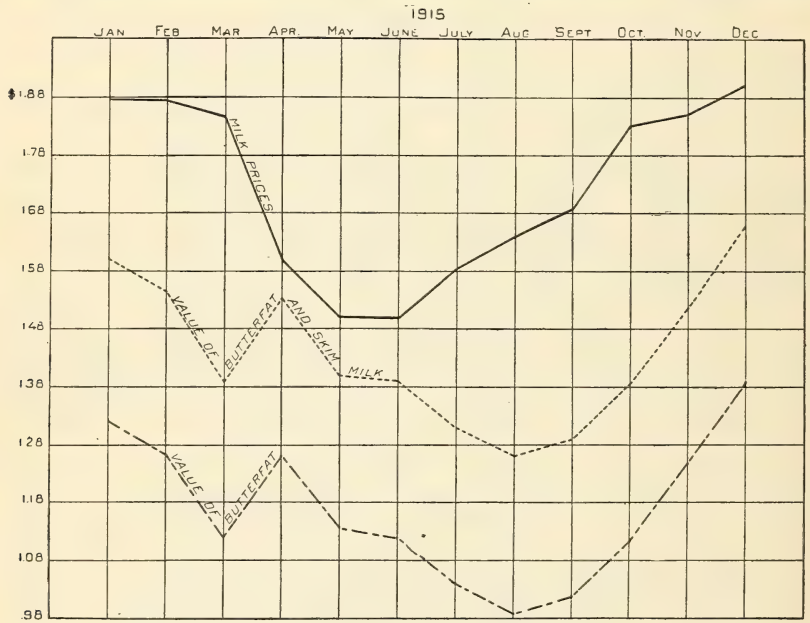

FIG. 3.—Comparisons of average prices paid by Detroit milk dealers with value of the milk if the cream had been delivered to local creameries and the skim milk fed to live stock on the farm.

the prices actually paid to farmers depended upon other factors as well. In territory where farmers could sell to local creameries or cheese factories the prices for milk were influenced by the prevailing market prices of butter and cheese.

Table III and figure 3 show the relation between average prices paid by the Detroit milk dealers in 1915 and the average monthly wholesale butter quotations in Chicago. The table and figure also present the estimated possible returns which farmers might have obtained if they had marketed their cream at local cooperative creameries, whose product is generally sold in accordance with Chicago quotations. The estimated returns are based upon the assumption

that skim milk has a value of 30 cents a hundredweight for feeding purposes. Ninety pounds of skim milk were allowed for each 100 of whole milk.

TABLE III.—*Average prices, by months, paid for 100 pounds of 3.7 per cent milk by all classes of milk dealers in Detroit; also estimated average returns for butterfat delivered to a local creamery.*

Months.	Average prices paid per hundredweight of milk.				Average prices per pound for butter.[1]	Possible returns from creameries.[2]	
	Small dealers.	Medium dealers.	Large dealers.	All dealers.		For butterfat per hundredweight of milk.	For butterfat plus 27 cents for 90 pounds of skim milk.
					Cents.		
January	$1.91	$1.884	$1.836	$1.876	31.7	$1.321	$1.591
February	1.91	1.884	1.823	1.872	30.437	1.264	1.534
March	1.91	1.864	1.77	1.848	27.204	1.119	1.389
April	1.68	1.678	1.442	1.60	30.375	1.262	1.532
May	1.68	1.63	1.180	1.73	27.46	1.130	1.400
June	1.68	1.588	1.235	1.501	27.175	1.118	1.388
July	1.795	1.618	1.343	1.585	25.5	1.042	1.312
August	1.68	1.720	1.523	1.641	24.293	.987	1.257
September	1.68	1.760	1.616	1.685	25.016	1.020	1.290
October	1.91	1.851	1.733	1.831	27.156	1.117	1.387
November	1.91	1.864	1.780	1.851	30.025	1.246	1.516
December	1.91	1.942	1.860	1.904	33.208	1.390	1.660
Total average	1.805	1.774	1.595	1.744	28.295	1.168	1.438

[1] Butter prices are the monthly averages of Chicago quotations on the basis of which most of the creameries of that section sell their butter.

[2] These returns are computed on basis of 3.7 per cent butterfat in milk and on the basis of 22 per cent overrun in butter manufacture, and a cost of 2.42 cents a pound for manufacture.

The table and figure also show that there was no constant relation between the monthly average wholesale prices of butter in the Chicago market and monthly average prices paid for milk by Detroit dealers. Farmers in that territory generally received higher prices for milk than they would have obtained if they had delivered the cream to local creameries for the manufacture of butter and had fed the skim milk on the farm. Farmers have found that it requires great care and expense to produce and deliver daily a good grade of market milk, whereas three deliveries a week are usually sufficient for buttermaking purposes.

At certain seasons of the year, however, some of the dealers bought milk for less than it would have yielded the farmers if it had been utilized in the manufacture of butter and the feeding of live stock, which may be explained by the fact that the companies which own and control country milk stations may obtain virtual buying monopolies in certain localities. The prices paid to farmers for milk usually depend upon existing competition. Small dealers who do not own or control country milk stations are generally unable to buy milk in distant areas. In the absence of market information and active competition of manufacturing plants it may also be possible to buy market milk for less than it would yield for manufacturing purposes.

COLLECTING AND HANDLING MILK IN THE COUNTRY.

The milk dealers in Detroit obtained their supplies of milk and cream either from individual farmers direct or through country receiving and cooling stations. The smaller dealers usually gathered their supplies near by, mainly because they could not afford the investments in country receiving stations, through which the larger dealers collect the most of their supplies from the more distant areas of production. (See fig. 1 and Table IV.) Most of the supply which came from neighboring territory was gathered from farms by means of wagons or motor trucks owned by the city dealers. Considerable quantities of both milk and cream were also shipped directly to the city by farmers who lived near railway stations or crossroads milk-shipping platforms. There was keen competition for all supplies of milk or cream directly accessible to the city.

In order to obtain milk from many farmers who lived too far from railroad stations or shipping platforms to make direct shipping practicable, it was necessary to establish facilities for collecting milk enough at one place to permit more economical transportation to the city plant. Farmers generally do not consider it advisable to make daily trips for delivering milk when the shipping station is more than 5 miles away. An additional advantage of the country receiving and cooling stations was that milk could be cooled to the proper temperature before it was shipped to the city; furthermore, the inspection and buying of milk according to quality was expedited. When a farmer watches the sampling of his milk and the making of sediment and butterfat tests he understands better the justice of paying different prices for different grades of milk. It often happens that dairy products can be manufactured more economically in the country than in the city, and for that reason the larger milk companies frequently operate country milk plants, where the surplus not required for market milk trade may be converted into other products.

Table IV shows the quantities of market milk obtained through country stations during June, 1915.

TABLE IV.—*Milk obtained through country stations during June, 1915.*

Number of wagons operated by dealers.	Number of dealers.	Number of stations from which milk was received.	Number of gallons received monthly.		Per cent of total shipped through stations.
			From stations.	From farms.	
1 to 5	55	.....	.....	291,600	.....
6 to 29	11	22	356,224	239,005	59.8
30 to 150	2	51	1,002,606	153,257	86.7
Total	68	73	1,358,830	683,862	66.5

The total number of gallons handled by different groups of dealers, as shown in Tables I and II, does not correspond to the total shown in Table IV, because large quantities of milk were bought from farmers by those dealers and not used for market milk purposes but manufactured into butter, cheese, condensed milk, powdered milk, and casein.

The larger companies obtained the greater part of their supply through the country milk stations or "collecting depots," which they usually owned. A few of the country stations were owned either by farmers' cooperative associations or by individual farmers whose dairy houses were equipped to handle truck loads of milk produced on neighboring farms. (See Pl. I, fig. 1.)

The typical milk-receiving station consisted of a wooden-framed building equipped with a small boiler, apparatus for washing and sterilizing milk utensils, scales for weighing milk, and a tank for holding the cans of milk in ice water until time to ship to the city. During the winter natural ice was usually stored in an adjoining building for use in the summer. Stations which skimmed or utilized surplus milk at certain seasons had additional and more expensive equipment, such as receiving tanks, mixing vats, cheese vats, separators, churns, pasteurizers, coolers, and equipment for condensing milk. (See Pl. I, fig. 2.)

Table V shows the relation of the amounts invested in 16 country milk stations to the number of gallons handled daily.

TABLE V.—*Relation of investment in country stations to gallons of milk handled daily during June, 1915.*

Station number.	Gallons of milk handled daily.		Investment in buildings and equipment.	Investment per gallon handled daily.
	Cooled.	Skimmed.		
1	77	.....	$380.00	$4.94
2	124	.....	818.00	6.60
3	172	.....	440.00	2.59
4	226	.....	876.00	3.88
5	317	.....	1,325.00	4.18
6	382	.....	1,675.00	4.39
7	447	.....	609.00	1.36
8	465	.....	1,325.00	2.85
9	779	.....	3,450.00	4.43
10	842	.....	4,553.00	5.41
11	1,009	.....	2,253.00	2.23
12	760	720	1,800.00	1.22
13	738	830	1,952.00	1.24
14	1,907	.....	4,752.00	2.49
15	1,404	1,155	2,053.00	.80
16	2,662	.....	5,745.00	2.16
Average	769	.....	2,125.00	3.17

The investment in the stations does not bear a direct relation to the quantity of milk shipped. Some of the stations were creameries or cheese factories which had been converted into receiving stations,

and neither the buildings nor the equipment had been specially provided for the milk-station business. In some cases the investment was larger than necessary when neither milk skimming nor dairy manufacturing was done. Table VI shows the daily expense of maintaining and operating the stations included in Table V.

TABLE VI.—*Average daily expense of collecting and handling milk at country stations during June, 1915.*

Station number.	Gallons handled daily.		Depreciation and interest on building and equipment.	Labor and supplies in plant.	Route costs of collecting milk.	Total station expenses.	Average cost per gallon handled.
	Cooled.	Skimmed.					
1	77	.....	$0.17	$0.90	.....	$1.07	$0.013
2	124	.....	.36	.70	.....	1.06	.008
3	172	.....	.20	.90	.....	1.10	.006
4	226	.....	.39	1.23	.....	1.62	.007
5	317	.....	.59	1.60	.....	2.19	.006
6	382	.....	.74	1.60	.....	2.34	.006
7	447	.....	.27	.97	.....	1.24	.002
8	465	.....	.59	2.47	.....	3.06	.006
9	779	.....	1.53	3.53	$4.50	9.56	.012
10	842	.....	2.02	2.87	3.20	8.09	.009
11	1,009	.....	1.00	2.70	.....	3.70	.003
12	760	720	.80	2.87	13.87	17.54	.011
13	738	830	.87	3.53	10.08	14.48	.009
14	1,907	.....	2.11	3.97	4.05	10.13	.005
15	1,404	1,155	.91	3.90	.....	4.81	.001
16	2,662	.....	2.55	5.63	.....	8.18	.003
Average	769	901	.94	2.48	7.14	5.64	.007

The average cost per gallon of milk for operating the stations varied greatly. When surplus quantities of milk and cream were manufactured into butter, cheese, etc., at country stations, the operating expenses were increased. Some stations, however, show higher operating expenses than others, because the cost of collecting the milk in the country was included in the statement of expenses.

COST OF COLLECTING MILK AT COUNTRY STATIONS.

The prices paid for milk were usually based upon its delivery f. o. b. the city plant. The cost of transportation, therefore, must be deducted in order to obtain the farmers' actual net returns. In order to get sufficiently large supplies at some stations the milk dealers had established "milk-collecting routes" for collecting milk and cream from farmers living as far away as 10 miles. At 19 country milk stations there were 843 patrons, of whom 503 had their milk delivered by paid route men.

The farmers' share of the costs of country collecting averaged 12½ cents a hundredweight and varied from 8 to 18 cents a 10-gallon can. In addition to the amount paid by the farmer, the milk dealers were sometimes obliged to pay the route men a bonus of from $2 to $3 a

trip, depending upon the length of the route. The varying costs on different routes at a single country station for country collecting are shown in Table VII.

TABLE VII.—*Cost of collecting milk, by routes, June, 1915.*

Number of route.	Number of patrons.	Pounds of milk.	Paid by farmers.	Paid by company.	Average total cost per hundredweight.
1	6	29,113	$29.11		$0.100
2	14	41,380	60.51	$75.00	.327
3	11	32,402	32.40	32.40	.199
4	13	35,815	46.18	75.00	.338
5	14	30,242	45.96	87.50	.441
6	20	67,911	117.72	117.72	.346
7	23	60,732	91.09	91.09	.299
8	16	48,544	76.76	76.76	.316
9	11	43,153	43.16	60.00	.239
10	4	11,629	14.09	14.09	.242

TRANSPORTATION OF MILK TO THE CITY.

A large portion of the milk produced within a radius of 20 miles of Detroit was "trucked" to the city plants either by team or by automobile, but the greater part of the total monthly receipts of milk and cream was shipped on either steam or electric railroads. Table VIII gives the total quantities of milk and cream (both sweet and sour) which were received in Detroit during the month of July, 1915.

TABLE VIII.—*Quantities of milk received in Detroit during July, 1915.*

Means of transportation.	Gallons.	Per cent of total.
Steam roads	630,990	41.8
Electric roads	637,860	42.3
Teams or automobile trucks	239,780	15.9
Total	1,508,630	100.0

The electric lines provided milk cars with side-extension decks which permitted two tiers of cans, while the shipments on steam roads were handled in ordinary baggage cars. The farmers delivered their milk to the shipping stations early in the morning, and most of it arrived in Detroit by noon of the same day. Very little milk was in transit more than 4 hours. In warm weather it was "precooled" either on the farm or at the country milk stations before it was shipped, as refrigeration was not provided (except in one instance) by the roads.

Table IX gives a comparison of the milk and cream tariffs (effective August 1, 1915) for shipments of 10-gallon cans of milk or cream into Detroit on the various transportation lines.

TABLE IX.—*Comparison of transportation rates on electric and steam railways in the Detroit market milk territory during the year 1915.*

Rates per 10-gallon can.	Distance, in miles, for which rates apply.			
	Detroit United Railways (electric).	Pere Marquette Railroad.	Michigan Central Railroad.	Grand Trunk Railroad.
$0.15	1-30	1-25	1-25	1-17
.20	.....	1-25	1-25	18-55
.21	.....	26-30	26-30	.....
.22	31-35	31-35	31-35	.....
.23	36-40	36-40	36-40	.....
.24	41-45	41-45	41-45	.....
.25	46-50	46-50	46-50	56-75
.26	51-60	51-60	51-60	.....
.27	61-70	61-70	61-70	.....
.28	71-80	71-80	71-80	.....
.29	81-90	81-90	81-90	.....
.30	91-100	91-100	91-100	76-100

In order to transport bottled milk from a milk-bottling plant about 30 miles from Detroit, an insulated milk car on the electric line was equipped with brine pipes by means of which the car could be refrigerated. Refrigeration was obtained by connecting the brine coils under the ceiling of the car with the brine tanks in the country milk plant, and while the car was being loaded the cold brine was pumped through the coils, thus cooling or refrigerating the car. Milk containers made of fiber were used in place of glass bottles. (See Pl. II, fig. 1.)

The concrete roads which extend into the country surrounding Detroit make it possible to haul a considerable portion of the milk direct from the farms or country milk stations to the city milk plants. Both horse-drawn and motor trucks are used for the purpose, although, because of their greater speed, the latter are superseding the former, especially on long hauls.

From a number of country milk stations milk was trucked to the city plants by the same men who had charge of the receiving and cooling operations. The actual amounts paid by milk dealers to persons who hauled milk from country stations to the city, by either motor or horse truck, were ascertained at several stations. Table X presents a comparison of the trucking costs with the transportation rates for equal distances by rail.

TABLE X.—*Costs of trucking milk compared with rail transportation rates.*

Number of station.	Average number of cans hauled daily.	Distance hauled (miles).	Comparative transportation costs per can.		
			Trucks.	Steam roads.	Electric roads.
1	30.7	12	$0.15	$0.20	$0.15
2	31.6	12	.15	.20	.15
3	46.5	12	.15	.20	.15
4	40.5	15	.175	.20	.15
5	112.5	15	.175	.20	.15
6	49.4	20	.175	.20	.15
7	41.1	25	.175	.20	.15
8	43.7	25	.175	.20	.15
Average	49.5	17	.1656	.20	.15

FIG. 1.—ONE OF THE NEWER COUNTRY STATIONS WHERE MILK WAS RECEIVED AND COOLED BEFORE BEING TRUCKED TO THE CITY OR TO THE RAILWAY SHIPPING POINT.

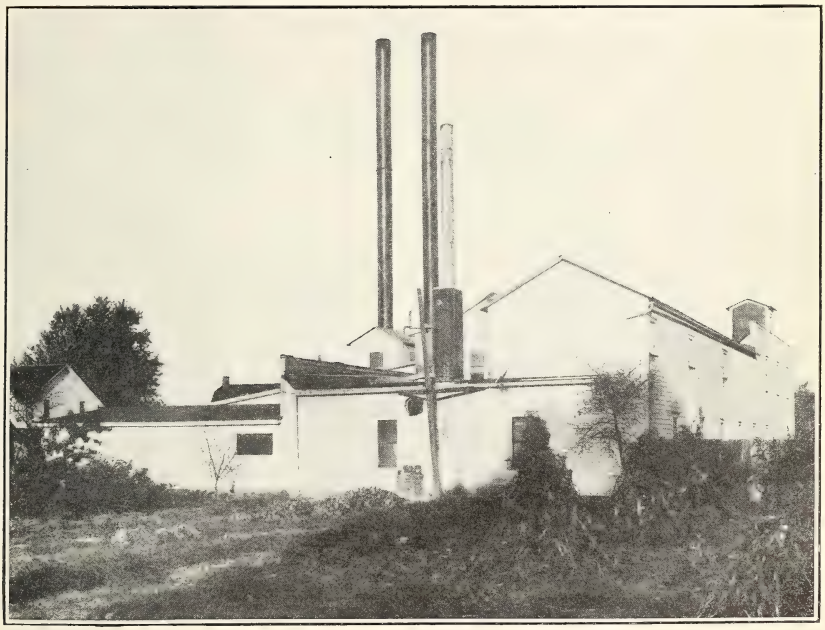

FIG. 2.—A CONDENSARY FROM WHICH SHIPMENTS OF MARKET MILK WERE MADE IN SUCH QUANTITIES AS WERE REQUIRED FROM DAY TO DAY.

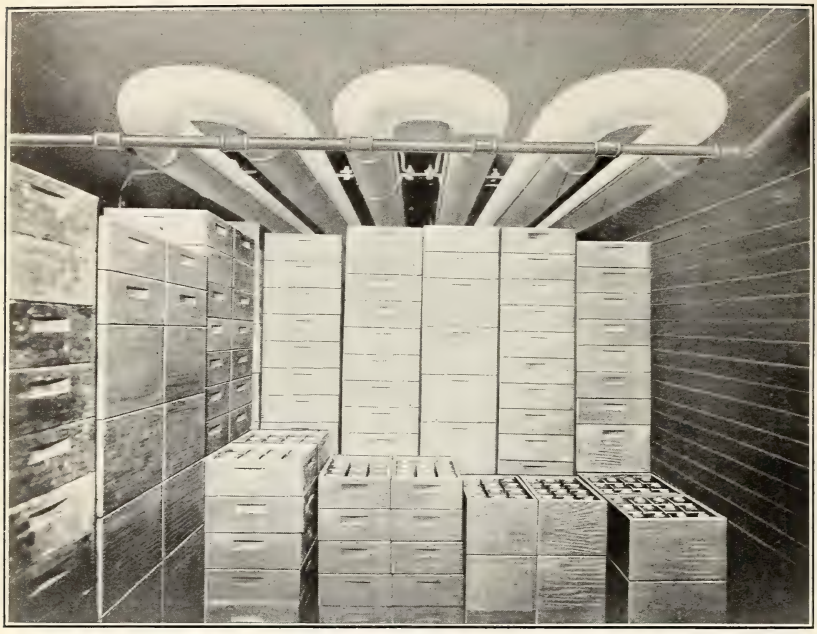

FIG. 1.—INTERIOR VIEW OF A SPECIAL REFRIGERATOR CAR USED FOR TRANSPORTING MILK IN FIBER CONTAINERS FROM A COUNTRY MILK PLANT TO DETROIT.

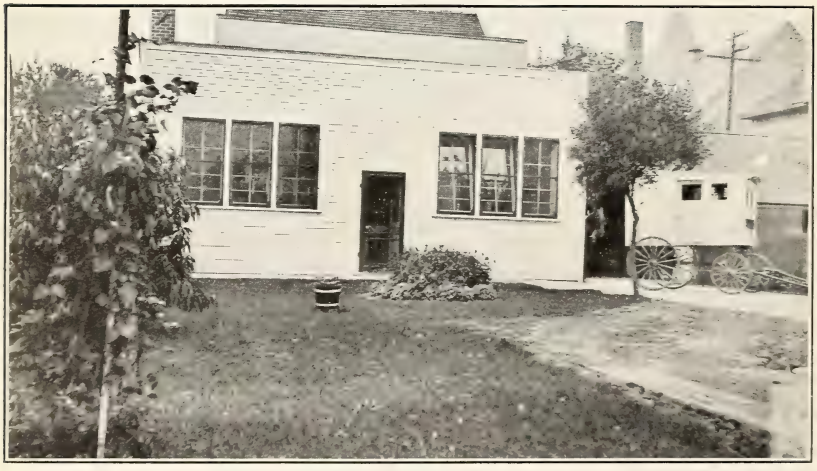

FIG. 2.—A CITY PASTEURIZING AND BOTTLING PLANT HANDLING APPROXIMATELY 145 GALLONS DAILY AND SUPPLYING TWO DELIVERY WAGONS.

The total investment in plant and equipment was $4,274, which was an average of $29.48 per gallon handled daily.

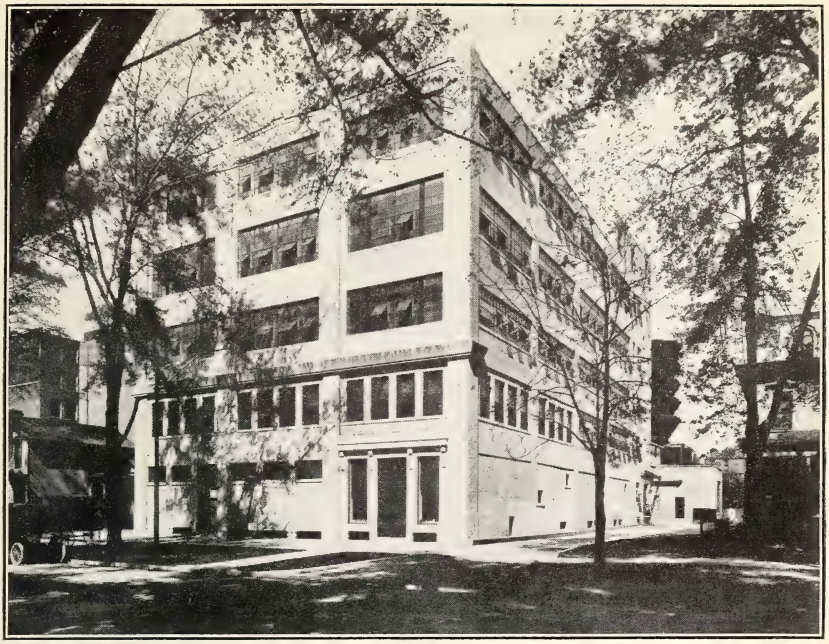

FIG. 1.—ONE OF THE LARGEST CITY MILK PLANTS, WITH A CAPACITY FOR HANDLING APPROXIMATELY 15,000 GALLONS DAILY.

The average per gallon investment for the group of largest plants in Detroit was approximately $30.

FIG. 2.—ATTRACTIVE BUT EXPENSIVE EQUIPMENT.

The disproportionate per gallon investments in equipment between small and large dealers are caused mainly by the well-kept and attractive horses, barns, wagons, and wagon sheds. Such costly investments, however, together with other advertising expenses, are necessitated by competition.

In most cases the cost of trucking was less than the cost of transportation by steam railroad and the same as by electric road. It should be explained that electric lines did not serve those stations where costs of trucking were higher than the rates for equal distances on the electric railways.

When the milk was shipped by either steam or electric roads, an additional cost of about 1½ cents for each 10-gallon can was usually incurred in trucking the milk from the city terminal milk platform to the city milk plant.

COST OF MILK DELIVERED TO THE CITY.

Figure 2 and Table III show the average prices paid by small, medium, and large dealers for milk f. o. b. Detroit. As shown in Table IV, the smaller dealers did not receive their supplies through country milk stations. To show the total cost of milk f. o. b. Detroit when received through country stations, and the relation of the costs of collecting and handling at these stations, the records of certain typical stations were obtained from a few dealers and are presented in Table XI.

TABLE XI.—*Relation of daily handling and transportation expenses at country plants to prices paid farmers and total cost of milk f. o. b. Detroit during June, 1915.*

Station number.	Paid farmers.		Costs of collecting and handling at country station.			Expenses of transporting to Detroit.		Total cost of milk f. o. b. Detroit.		
	Amount per day.	Net price per gallon.	Amount per day.	In per cent of amount paid farmers.	Cost per gallon.	Amount per day.	Cost per gallon.	Amount per day.	In per cent of amount paid farmers.	Total cost per gallon.
1	$7.00	$0.092	$1.07	1.5	$0.013	$1.13	$0.014	$9.20	131.3	$0.119
2	12.00	.098	1.06	8.8	.008	1.83	.014	14.89	124.0	.120
3	17.00	.099	1.10	6.4	.006	4.73	.027	22.83	134.2	.132
4	22.00	.098	1.62	7.3	.007	3.37	.014	26.99	122.6	.119
5	30.00	.095	2.19	7.3	.006	2.57	.008	34.76	115.8	.109
6	44.00	.116	2.34	5.3	.006	5.70	.014	52.04	118.2	.136
7	44.00	.100	1.24	2.8	.002	6.70	.014	51.94	118.0	.116
8	54.00	.117	3.06	5.6	.006	6.97	.014	64.03	118.5	.137
9	99.00	.128	9.56	9.6	.012	11.67	.014	120.23	121.4	.154
10	85.00	.102	8.09	9.5	.009	23.57	.027	116.66	137.2	.138
11	108.00	.108	3.70	3.4	.003	27.23	.026	138.93	128.6	.137
12	83.00	.115	17.54	21.1	.011	17.47	.011	118.01	142.1	.137
13	98.00	.148	14.48	14.7	.009	16.23	.010	128.71	131.3	.167
14	267.00	.141	10.13	3.7	.005	51.47	.026	328.60	123.0	.172
15	141.00	.114	4.81	3.4	.001	33.67	.013	179.48	127.2	.128
16	284.00	.107	8.18	2.8	.003	71.83	.026	364.01	128.1	.136
Average	87.00	.113	5.63	7.0	.006	17.88	.017	110.70	126.3	.134

The "net prices" paid farmers at different stations during the month of June, 1915, varied from 9.2 cents to 14.8 cents a gallon. These prices are not the same as those quoted in the schedule of prices for milk delivered f. o. b. Detroit, but are what the farmers actually received at the particular stations after transportation costs had been

deducted. The average costs of collecting, handling, and transporting to city amount to approximately 25 per cent of the net price paid to the farmers. The last column of the table shows that the cost of milk delivered in Detroit varied considerably, depending upon where it was bought and the varying costs of collecting, handling at stations, and transportation to the city. The dealers paid varying prices in different communities, in accordance with the local competitive conditions and the city demands for market milk. There was no fundamental cost basis for the prices which then prevailed in the Detroit territory. (See also Table II and fig. 2.)

TRADE DEMANDS IN DETROIT.

The business of milk dealers usually consisted of a combination of wholesale and retail trade. The wholesale trade required milk and cream in both cans and bottles; hotels, restaurants, ice-cream manufacturers, and bakeries generally purchased bulk goods, while hospitals, sanitariums, saloons, and soda fountains required both bulk and bottled goods. Retail stores also bought bottled goods at wholesale prices. Prices paid by that class of trade varied greatly, depending largely upon the grade and quantity purchased, as well as upon changing market conditions. Wholesale prices for common milk generally fluctuated around 22 cents a gallon in bulk and 7 cents a quart in bottles.

The retail trade of milk dealers consisted of sales to families and (for luncheon) to office and factory workers. The retail price for common milk in Detroit during June, July, and August, 1915 (the time covered by this study) was about 8 cents a quart.

Table XII shows the variation of demand on retail milk routes.

TABLE XII.—*Variable demands of retail customers for milk, cream, and other milk products, by different retail routes.*

Number of customers on route.	Common milk.				Certified and special.				Cream.						Butter-milk.		Average daily sales.		Total bills receivable.	Average credit per customer.
	Number of quarts.	Per cent of customers.	Number of pints.	Per cent of customers.	Number of quarts.	Per cent of customers.	Number of pints.	Per cent of customers.	Number of pints.	Per cent of customers.	Number of half pints.	Per cent of customers.	Number of quarter pints.	Per cent of customers.	Number of quarts.	Per cent of customers.	Per route.	Per customer.		
351	122	34.7	236	67.2	3	0.8	4	1.1	3	0.8	34	9.6	24	6.8	4	1.1	$24.44	$0.069	$247.00	$0.703
214	92	42.9	130	60.7	5	2.3	...	...	...	...	7	3.2	12	5.6	2	.9	14.50	.067	183.00	.855
343	156	45.4	215	62.6	4	1.1	5	1.4	4	1.1	43	12.5	25	7.2	8	2.3	27.70	.080	409.00	1.192
273	109	39.9	188	68.8	3	1.0	4	1.4	5	1.8	30	10.9	35	12.8	10	3.6	22.22	.081	261.00	.956
319	130	40.7	207	64.8	8	2.5	2	.6	...	....	28	8.7	28	8.7	10	3.1	24.02	.075	339.00	1.062
356	129	36.2	239	67.1	...	....	...	....	...	....	51	14.3	57	16.0	6	1.6	26.54	.074	351.00	.985
336	134	39.8	252	75.0	1	.2	...	....	...	....	12	3.5	1	.2	13	3.8	22.61	.067	234.00	.696
344	183	53.1	251	72.9	1	.2	4	1.1	...	....	8	2.3	4	1.1	10	2.9	26.54	.077	321.00	.933
342	157	45.9	250	73.0	10	2.9	2	.5	2	.5	33	9.6	25	7.3	6	1.7	28.62	.083	440.00	1.286
125	70	56.0	70	56.0	2	1.6	2	1.6	3	2.4	20	16.0	12	9.6	7	5.6	11.83	.093	176.00	1.408
Average, 300	128	42.6	204	68.0	3.7	1.2	2.3	.7	1.7	.5	26.6	8.8	22.3	7.4	7.6	2.5	22.90	.076	296.00	.986

The table shows also that the milk dealers of Detroit handled a variety of goods in various-sized containers, some of which were demanded by relatively few customers. This custom has developed because it was found advisable to supply the exact quantities in the kind and size of containers demanded. To increase the demand for

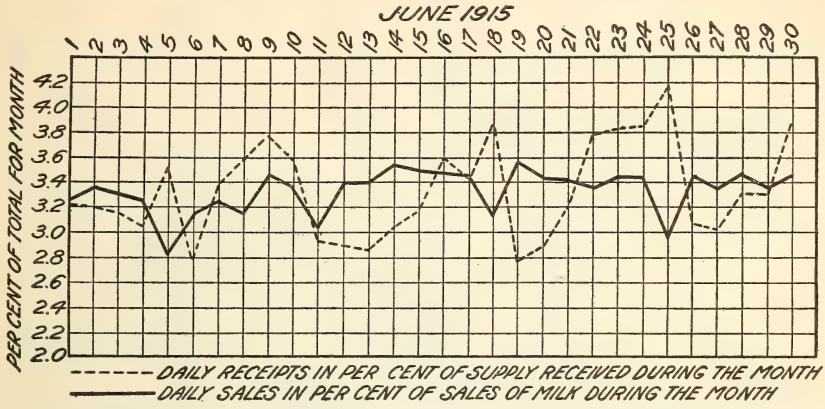
JUNE 1915
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
PER CENT OF TOTAL FOR MONTH
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
DAILY RECEIPTS IN PER CENT OF SUPPLY RECEIVED DURING THE MONTH
DAILY SALES IN PER CENT OF SALES OF MILK DURING THE MONTH

FIG. 4.—Daily fluctuation in receipts and sales of milk in per cent of total supply and sales for the month.

some special goods certain dealers often advertise them extensively, because it also tends to increase the sales of common milk and cream.

The fluctuating daily demands in relation to the monthly sales of market milk are illustrated by figure 4. The daily sales of market

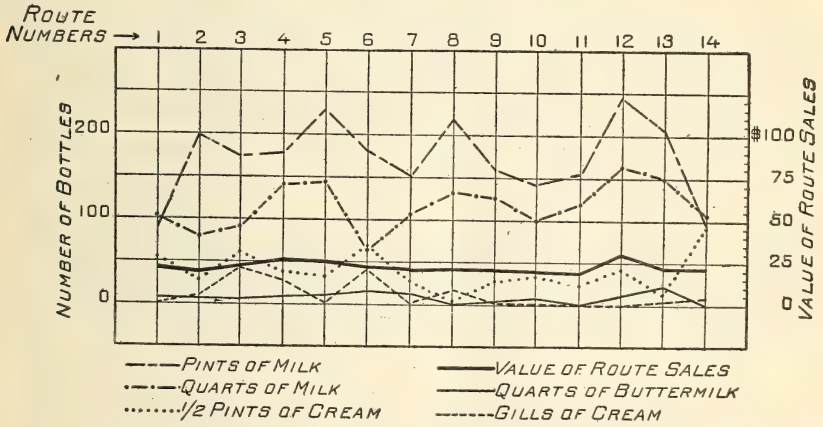

FIG. 5.—Chart showing one day's sales on 14 retail routes serving approximately an equal number of customers.

milk are shown in per cent of the total sales for the month. In order to furnish the exact quantities of goods that might be required by the trade at any time and hold the business, it was necessary for milk dealers to have on hand a sufficient quantity of goods to supply all probable demands. To avoid excessive losses from surplus

FIG. 6.—Location of city milk plants in Detroit before compulsory pasteurization.

quantities which were not needed by the trade, dealers utilized the surplus by manufacturing it into some less perishable product, such as butter, cheese, or condensed milk.

The various demands of consumers for goods put up in different-sized containers are graphically illustrated in figure 5. Although there were approximately an equal number of customers on each of the 14 routes, and though the value of sales was approximately the same, the demands for goods in different-sized containers varied greatly. To supply the demands for market milk and its derivatives it was necessary for dealers to equip their plants properly for distributing in the city the milk received from various producers in the country.

PREPARING MILK FOR CITY DISTRIBUTION.

BEFORE COMPULSORY PASTEURIZATION.

Prior to the enforcement of the milk-pasteurization ordinance there were 158 milk dealers in Detroit, and the "plants" were situated in different parts of the city, as shown in figure 6. Twenty-four dealers used the "flash" method of pasteurization and 19 the "holding" process. There were 91 dealers who bottled raw milk, each

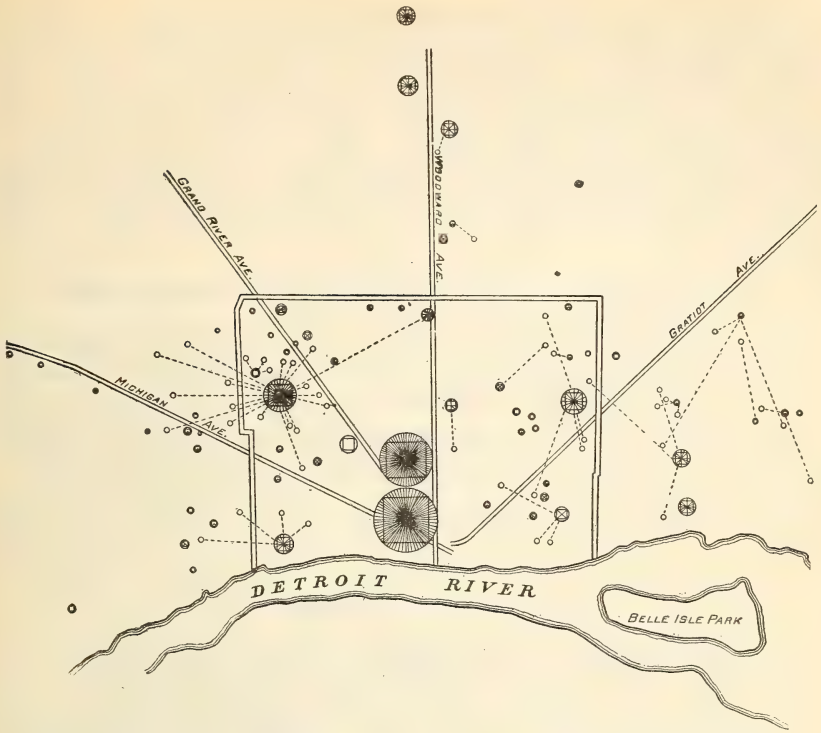

FIG. 7.—System of city distribution of market milk in Detroit after compulsory pasteurization.

handling from 40 to 1,500 gallons daily. Only a few of the smaller plants were equipped with steam boilers, the greater portion using gas heaters to furnish hot water for washing the milk bottles and utensils. Forty-four dealers purchased pasteurized milk in bulk from 23 other dealers, which they bottled and sold to both retail and wholesale trade.

The records of the Detroit Board of Health showed higher bacterial counts in milk pasteurized by the flash method than that pasteurized by the holding method. The pasteurized milk which was purchased from other dealers often showed higher bacterial counts than the samples of the raw milk before pasteurization. The bacterial counts were usually higher in the pasteurized milk purchased from other dealers for bottling than in that which was pasteurized and bottled in the same plant.

AFTER COMPULSORY PASTEURIZATION.

The pasteurization ordinance which became effective May 1, 1915, required that all milk be pasteurized by the holding process in plants equipped in accordance with regulations adopted by the milk-inspection department of the city board of health.

August 1, 1915, three months after the pasteurization ordinance became effective, there were 68 plants in which milk was prepared for market distribution. Approximately 75 per cent of the total milk supply was pasteurized by 11 dealers whose average daily output per plant was more than 3,600 gallons. About 10 per cent of the city's milk supply was distributed by small dealers who purchased their supplies from other dealers who operated pasteurizing plants. (See fig. 7.)

CAPITAL INVESTED AND COST OF HANDLING MILK AT CITY PLANTS.

To show the investments required for milk plants and equipment, and the varying costs of handling milk in preparing it for distribution in the city, the records of 28 representative dealers were obtained. Table XIII shows the varying investments in relation to the operating costs in the plants, according to increasing costs of handling.

TABLE XIII.—*Relation of cost of handling to capital investments, supplies, and labor in twenty-eight city milk plants.*

Handling cost per gallon.[1]	Gallons handled daily.	Investments.		Supplies.[2]		Labor.	
		Total.	Per gallon handled daily.	Per day.	Per gallon.	Per day.	Per gallon.
Cents.					*Cents.*		*Cents.*
2.3	1,600	$13,300	$8.31	14.96	0.9	$13.68	0.9
2.4	350	4,320	12.34	11.84	1.2	1.99	.6
2.6	9,706	267,575	27.57	70.01	.7	167.82	1.7
2.6	2,000	16,824	8.41	16.57	.8	27.21	1.4
2.7	850	7,154	9.54	5.48	.7	10.68	1.4
2.8	1,450	41,643	28.72	9.76	.7	14.25	1.0
3.1	1,450	18,720	12.90	18.42	1.3	17.03	1.2
3.3	220	1,917	8.71	2.45	1.1	3.81	1.7
3.3	340	3,502	10.30	3.24	1.0	5.98	1.8
3.4	470	2,527	5.38	4.87	1.0	9.86	2.1
3.6	400	5,312	13.28	4.20	1.0	7.40	1.9
3.7	165	3,029	18.36	1.95	1.2	2.71	1.6
3.8	2,119	97,457	45.99	11.79	.6	47.31	2.2
3.9	425	7,595	17.87	5.61	1.3	7.12	1.7
4.4	335	4,542	13.56	5.43	1.6	5.98	1.8
4.4	100	1,186	11.87	1.64	1.6	2.00	2.0
4.5	310	3,847	12.41	5.18	1.7	5.84	1.9
5.2	230	4,927	21.42	2.35	1.0	7.13	3.1
5.2	1,300	7,315	5.63	36.10	2.8	9.97	.8
5.3	100	1,829	18.29	1.18	1.2	2.99	3.0
5.4	240	7,141	29.75	3.70	1.5	6.04	2.5
5.4	530	20,251	38.21	6.76	1.3	10.54	1.0
6.1	135	1,829	13.55	1.57	1.2	5.60	4.1
6.8	85	2,705	31.82	1.24	1.5	3.00	3.5
6.8	1,260	110,592	87.77	33.78	2.7	21.80	1.7
7.0	145	4,274	29.48	3.58	2.5	4.70	3.2
7.1	90	2,762	30.69	2.18	2.4	2.56	2.8
7.2	40	1,725	43.13	.51	1.3	1.50	3.8
Ave. 4.4	940.9	23,778	21.97	10.23	1.4	15.23	2.01

[1] These unit costs include charges for depreciation and interest on capital invested, supplies, and labor expenses (all the items which could be definitely charged against handling in plant).
[2] Supplies include charges for fuel, ice, power and light, bottles, caps, washing powder, brushes, etc.

A study of the table reveals rather wide variations in the costs of handling milk in the different plants, many of which are caused by the varying proportions of bottled and bulk milk handled. The

average costs per gallon handled at the different plants, therefore, are not exactly comparable, for it does not cost so much to pasteurize and put into cans the milk sold to other dealers or to wholesale trade as it does to pasteurize and bottle milk for the retail trade.

It is important to note the disproportionate investments in milk plants and equipment. The investments per gallon handled daily range all the way from $5.38 to $87.77, and illustrate the lack of standardization of milk plants and equipment. It is obvious that a relatively low investment greatly reduces the interest and depreciation charges against each gallon handled. In those plants where the operating costs per unit were the lowest, the investments per gallon were generally comparatively small and the expenditures for supplies and labor in proportion to capital invested were greater. (See Pl. II, fig. 2, and Pl. III, fig. 1.)

Some of the disproportionate investments may be accounted for by the fact that some plants were old and handled a large proportion of bulk milk, whereas others were newly built for the purpose of increasing the business.

CITY DISTRIBUTION OF MILK.

The number of milk dealers engaged in the business of distributing milk in Detroit, August 1, 1915, and the size of the business of those dealers grouped according to number of delivery wagons operated, are shown in Table XIV.

TABLE XIV.—*Quantity of milk and cream distributed daily by dealers (grouped according to number of wagons operated).*

Number of wagons.	Number of dealers.	Total number of wagons.	Average number of wagons per dealer.	Gallons sold daily.		Per cent of total.
				Milk.	Cream.	
1 to 5	127	201	1.5	15,179	271	28.8
6 to 15	7	80	11.4	8,340	367	16.3
16 to 30	4	70	17.5	6,050	215	11.7
31 to 150	2	235	117.5	18,000	5,100	43.2

On August 1, 1915, there were 140 milk distributors, or 18 fewer than on May 1, when the pasteurizing ordinance became effective. Of these dealers 127 operated from 1 to 5 wagons each. Two of the larger companies, operating more than 30 delivery wagons each, together distributed nearly 44 per cent of the total milk supply of the city.

Figure 7 is a graphic presentation of the system of distribution which prevailed in August, 1915. The locations of the milk-pasteurizing and bottling plants are indicated by squares. The areas of the squares represent the relative quantities of milk pasteurized in the

plants. The small circles indicate the location of the different dealers in the city. The number of radii within the circle represents the number of delivery routes operated by each dealer. When a dealer purchased his supply from a pasteurizing and bottling plant, a broken line shows his connection with the plant from which the supply was obtained. A comparison of the map with figure 6, which presents conditions on May 1, 1915, shows that the number of city milk plants was reduced on August 1, but that the number of milk dealers had not decreased greatly.

In addition to the dealers referred to in figure 7 there were two dealers who operated plants in the country where milk was pasteurized, bottled, and shipped to Detroit. By selling to hotels, restaurants, and factories it was possible for one of the suburban plants to sell practically its entire supply at wholesale. The other plant bottled a considerable portion of its supply in the country, and either shipped the remainder in bulk to the city or manufactured it into cheese. This plant used fiber containers instead of glass bottles for goods sold in retail quantities. Instead of delivering direct to consumers, which would have required an investment in retail delivery equipment and the maintenance of a city sales organization, arrangements were made with grocery stores to retail the milk. There were some objections to the use of fiber containers, but storekeepers generally accepted them, because no losses were incurred by the failure of customers to return the empty bottles. The use of these containers was very successful for that class of trade.

Table XV shows the proportion of retail and wholesale trade of dealers handling different quantities of milk.

TABLE XV.—*Relation of retail to wholesale business.*

Number of wagons.	Average number of wagons per dealer.	Quarts sold daily.		Per cent sold.	
		Retail.	Wholesale.	Retail.	Wholesale.
1 to 5	1.5	34,752	25,964	57.2	42.8
6 to 15	11.4	20,700	12,660	62.0	38.0
16 to 30	17.5	12,900	11,300	53.3	46.7
31 to 150	117.5	45,600	26,400	63.3	36.7

Different dealers had various proportions of wholesale and retail business, and there was no definite relation between the quantity of milk handled and the proportion of wholesale to retail sales.

The relation of the size of a dealer's business to the daily variation in quantities of market milk sold at wholesale and retail is shown in figure 8. While the records of both the larger and smaller dealers showed considerable variation in their total daily sales, the sales of

the larger companies fluctuated less than those of the smaller ones, possibly because their ownership of country stations enabled them to provide an ample supply and better facilities for utilizing any surplus. The smaller concerns, because of the comparatively small quantities handled, usually found the manufacture of by-products to be less profitable than the selling of a temporary surplus to wholesale trade even at greatly reduced prices.

The small dealers usually made both wholesale and retail deliveries from the same wagon, while the larger dealers generally operated their wholesale routes separately. Because of the irregular and exacting service required by the wholesale trade, a large part of the sales to that class of trade is often made by special delivery trucks. Figure 8 gives a graphic presentation of the comparative amounts of wholesale business of large dealers handled by special delivery.

Table XVI shows the investment required for delivery equipment in relation to the cost of delivering milk from city plants to the various classes of trade.

TABLE XVI.—*Relation of costs per quart delivered to investments in delivery equipment, average number of quarts delivered per wagon, and per cent of sales at retail for 28 dealers.*

Cost per quart.[1]	Investments in delivery equipment.		Number of delivery wagons.	Average quarts delivered per wagon daily.	Per cent of sales at retail.
	Total.	Per gallon delivered daily.			
Cents.					
0.5	$1,005.00	$3.24	1	1,240	0.0
.8	956.00	4.35	3	293	77.3
.9	1,527.00	9.25	1	660	50.0
1.1	14,899.10	8.92	14	477	54.5
1.2	527.50	4.06	2	260	73.1
1.2	7,280.00	6.31	12	384	62.5
1.2	2,480.00	6.12	4	405	47.1
1.2	8,779.00	6.05	14	414	93.3
1.2	870.00	8.70	1	400	77.2
1.3	2,907.00	12.11	3	320	60.0
1.3	1,180.00	8.74	1	540	77.3
1.3	40,050.85	18.90	14	605	58.9
1.4	170,090.04	17.52	99	392	81.3
1.4	15,055.50	9.45	16	400	53.3
1.4	692.00	8.14	1	340	62.5
1.4	2,096.00	6.45	3	433	76.9
1.4	8,779.00	6.86	14	366	34.5
1.5	3,030.00	10.10	4	300	65.0
1.5	1,160.00	4.64	5	200	50.0
1.5	1,595.50	6.94	3	307	73.8
1.5	575.00	14.38	1	160	85.0
1.6	1,570.00	17.44	2	180	61.5
1.6	2,740.00	8.06	4	340	74.5
1.6	7,375.00	17.35	4	425	65.0
1.7	785.50	7.85	2	200	64.3
1.7	2,623.33	7.83	3	447	71.4
1.8	2,831.50	5.34	6	353	80.0
2.5	29,225.35	23.19	20	252	56.9
[2] 1.38	[2] 11,881.75	[2] 9.58	[2] 9	[2] 396	[2] 63.9

[1] These unit costs do not include items of administration, office expenses, advertising, licenses, insurance, taxes, and other miscellaneous expenses.
[2] Average.

Table XVI shows that the cost of delivering a quart of milk in the city is dependent upon many things besides the average number of quarts delivered daily by each delivery wagon. The most economical delivery was effected by a dealer who sold bottled milk exclusively, but delivered in relatively large quantities to retail stores only. The dealer whose delivery cost per quart was the highest had comparatively small average sales per wagon in relation to the proportion of sales made to wholesale trade. The figures suggest possible economies in milk distribution if all sales were made through the medium of established retail stores. The table, however, does not indicate the cost of delivering to the consumer by the retail stores.

The item "investments in delivery equipment" includes horses, barns, wagon sheds, automobile trucks, delivery wagons, and sundry articles used in delivering milk. The reasons for the wide variations

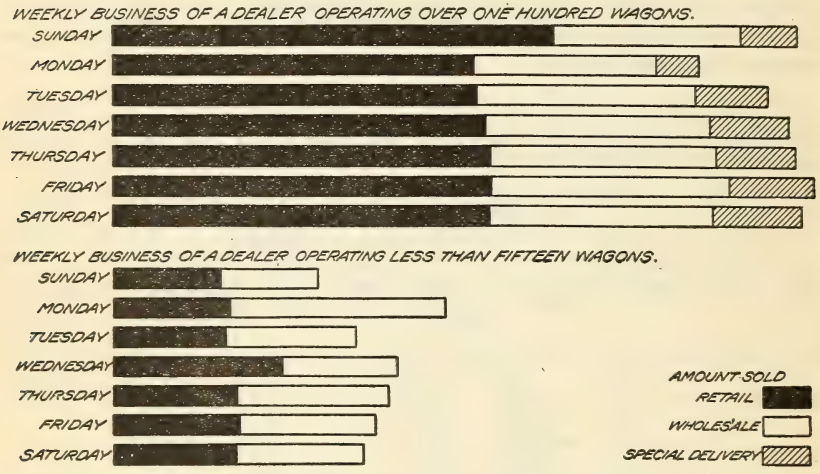

FIG. 8.—Relation of size of business to fluctuations in daily sales at wholesale and retail.

in delivery investments per gallon delivered are the varying proportions sold at wholesale, and the fact that some of the larger dealers had unusually high-priced horses and very costly stables. Such unusually large investments in delivery equipment are maintained for advertising as well as for direct utility. (Pl. III, fig. 2.)

Figure 9 illustrates the cost of city delivery in relation to amount of sales on 14 city delivery routes. Routes Nos. 1, 7, and 9 were engaged in a strictly wholesale delivery of bottled milk to retail stores, restaurants, and hotels. The business on the other routes consisted mainly of retail delivery at the family door, with only a few deliveries to grocery stores.

The heavy line in the figure shows the variation in the value of daily sales on the routes. Pasteurizing and bottling expenses at the city plant are included in the item "cost of goods." The item "cost

of goods and selling expenses" does not include overhead charges for taxes, administrative expenses, or losses occasioned by breakage or spoilage of goods on routes. The chart is designed to show the profit from business on different sales routes. Some routes show a good margin of profit, while others are run at an actual loss. The dealer who would expand his business under existing competition often finds it advisable to build up new routes at the expense of other routes which are profitable. Such expenses are the inevitable results of any competitive system of distribution. Figure 9, like Table XVI, suggests that considerable savings in delivery costs can be effected through a more centralized distributing organization.

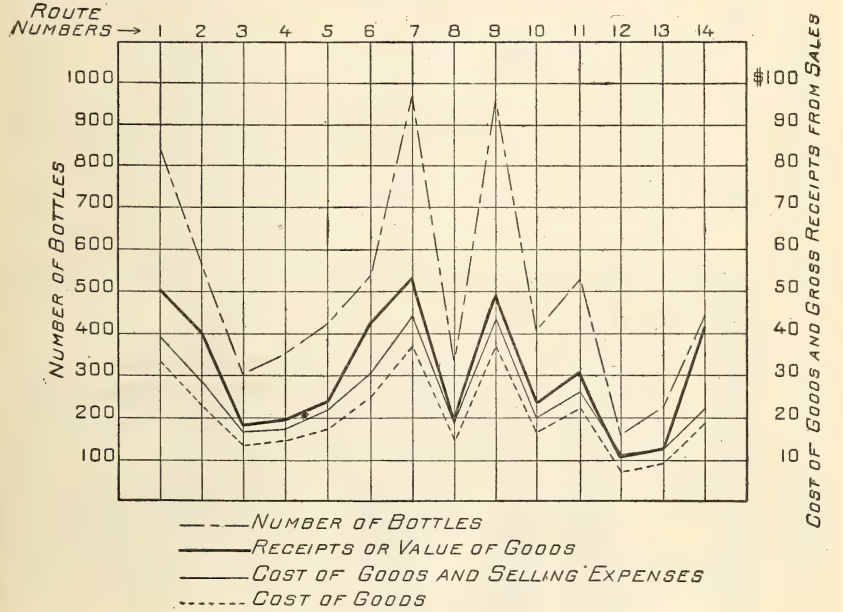

FIG. 9.—Average number of bottles delivered and value of sales in relation to cost of goods and expenses of delivery on 14 selected routes.

SUMMARY OF COMPARATIVE COSTS OF HANDLING AND DISTRIBUTING MILK.

In the foregoing tables and figures only such expenses were included as might be definitely allocated or fairly apportioned to either the expenses of handling milk in plants or of delivering in the city. Miscellaneous expenses, insurance, taxes, and charges for advertising, administrative, and office expenses were not included in any tables or graphs. In order to bring out some of the comparative advantages and disadvantages of small and large businesses, these items of expense are included in Table XVII, which shows the average per gallon investments and expenses of 28 dealers grouped according to the number of gallons handled daily.

TABLE XVII.—*Comparative investments and costs per gallon of handling and distributing milk by 28 dealers grouped according to quantities handled.*

Dealers grouped according to number of gallons handled daily.		For handling.				For delivery.				For administration.							
Range of gallons handled.	Average of group.	Investment per gallon handled daily.	Interest and depreciation.	Supplies.[1]	Labor.	Investment per gallon handled daily.	Interest and depreciation.	Supplies.[2]	Labor.	Investment per gallon handled daily.[3]	Interest and depreciation.	Supplies.[4]	Salaries.[5]	For advertising.	For licenses, insurance, and taxes.	For miscellaneous expenses.	Total of all expenses.
	Galls		*Cts.*	*Cts.*	*Cts.*		*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*
Less than 150.....	99	$23.725	1.2	1.7	3.20	$9.117	0.48	1.08	3.36	.....	.....	0.10	0.5	.....	0.10	.....	11.72
151 to 500.	315	13.870	.6	1.3	1.8	8.348	.38	.91	2.94	0.489	0.02	.09	.73	.....	.08	.....	8.85
501 to 1,000....	640	21.535	1.0	1.0	1.7	6.404	.39	.85	3.50	.165	.007	.10	1.30	.....	.04	.....	9.90
1,001 to 1,500....	1,365	32.485	1.2	1.8	1.2	10.039	.54	1.01	3.46	.516	.02	.02	.90	.....	.04	.01	10.20
1,501 to 2,000....	1,800	8.395	.4	.9	1.1	9.160	.61	.83	2.54	.183	.01	.10	.70	.....	.05	.03	7.30
2,001 to 3,000....	2,119	45.625	1.0	.6	2.2	18.980	.43	.92	3.69	.730	.04	.40	.70	.30	.20	.06	10.50
More than 3,000....	9,706	27.375	.2	.7	1.7	17.520	.21	1.29	4.01	6.570	.29	.25	.43	.05	.20	.....	9.30
Average of all groups..	2,292	24.715	.8	1.142	1.842	11.3666	.43	.98	3.36	1.236	.0645	.151	.751	.175	.091	.003	9.819

[1] See note below Table XIII, page 18.
[2] Supplies for delivery include charges for horse feed and shoeing, lanterns, automobile supplies, milk carriers, etc.
[3] Investment for administration include office furniture and appliances.
[4] Supplies for administration include office supplies, such as route books, accounting forms and books, tickets, stationery, electric lights, etc.
[5] Salaries for administration include salaries of office clerks and administrative officers. In some plants only a part of a man's salary was charged to the item, as some of the time was charged directly to labor for either handling or delivery.

Table XVII and figure 10 show that on the average the cost of handling milk is less in the larger-sized plants than in the smaller ones. The groups handling daily from 1,001 to 1,500 gallons and

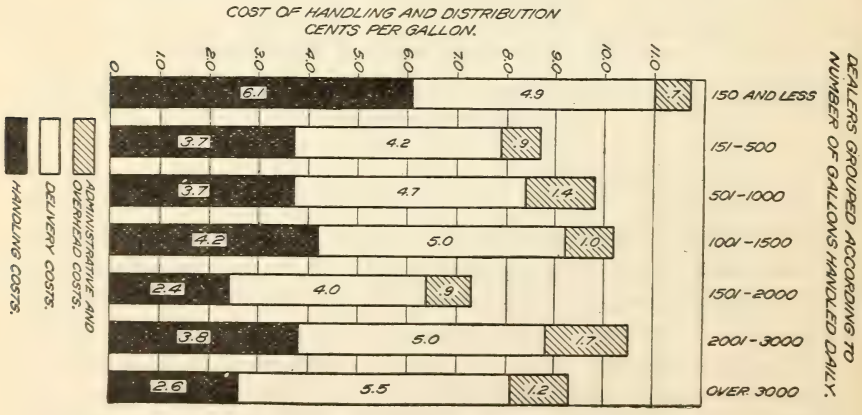

FIG. 10.—Cost of handling and distributing a gallon of milk.

from 2,001 to 3,000 gallons do not conform strictly to the general tendency, because the plants in these groups had large investments in buildings and equipment, and were not operated at full capacity in all cases. The delivery costs per gallon do not vary in accordance with the size of the business; the reasons are indicated in Table XVI and figure 9.

Figure 11 shows graphically the differences in per gallon investments by dealers, grouped according to number of gallons handled daily. The extremely disproportionate investments for both handling and delivering are explained in the discussion following Tables XIII and XVI. The general tendency, however, was for the handling investment to increase with the size of the plant to the point of a plant handling as high as 2,001 to 3,000 gallons. The group handling 1,501 to 2,000 gallons has a disproportionately low investment because in that group the dealers had equipped some old wooden buildings for temporary use until thoroughly modern plants could be constructed and satisfactorily equipped. Plants handling less than 150 gallons present another exception to the general tendency which in part can be explained by the fact that they were not operated at full capacity. The figures would also indicate that unless a dealer can handle at least 150 gallons his plant investment charge will be high. It will be noted that in general the larger dealers had greater investments in delivery equipment than the smaller ones. That is in part explained by the fact that many of

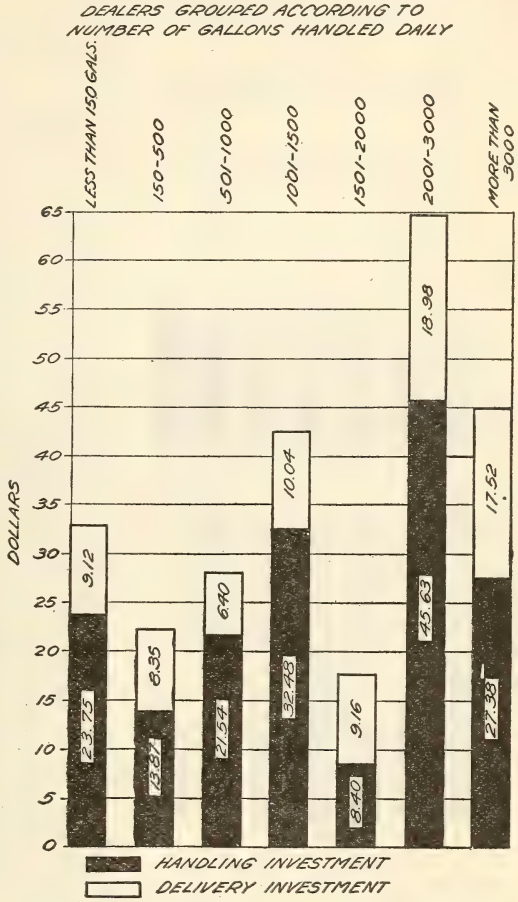

FIG. 11.—Average investments per gallon for handling and distributing milk.

the larger dealers maintained expensive barns and wagons, while some of the smaller ones had much less costly delivery outfits.

The differences in costs of supplies and in the charges for interest and depreciation are in the main the result of differences in the per gallon investments. Figure 12 shows radical differences in the cost of supplies in milk plants. As many of the dealers had operated their newly equipped plants for only a short time, and since some plants were not arranged efficiently or were not operated at full capacity, the most economical use of supplies was not possible. Aside from advantages of business experience, however, and differences in the extent to which machinery was run at full capacity, the larger dealers were able to effect considerable economies by the purchase of supplies in large quantities.

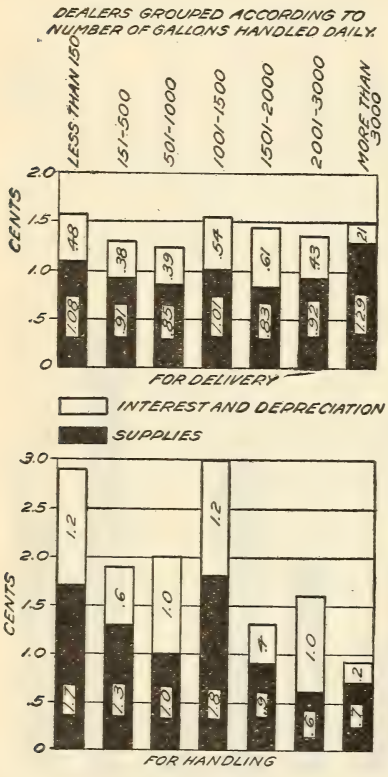

FIG. 12.—Variations in charges for interest and depreciation and cost of supplies per gallon.

Figure 13 shows that the larger dealers have lower labor costs per gallon in plant operations than the smaller plants, owing to the economies effected through specialization of labor. The apparent exception in the case of the two larger groups is to be explained by the fact that a larger proportion of their output consisted of bottled goods than in the case of the smaller plants. In delivering milk, however, there appears to be no definite relation between the size of the business and the per gallon labor costs.

The figures of the comparative costs in Table XVII represent the expenses of handling at the city plant and of delivering to the various classes of trade. They do not include, however, such expenses as are imposed on the business by surplus milk, soured or spoiled milk, shrinkage in handling, shortages on delivery routes, and bad bills. These items of loss or expense of the business were not obtainable from many dealers, because of a lack of efficient business organization or inadequacy of accounting systems to check such losses. On account of the omission of those items of expense, Table XVII possibly does not bring out all the comparative economies of large

and small businesses. (See fig. 10.) The losses from spoilage and temporary surplus or shortage of a supply of milk were comparatively less for the larger dealers. In the case of all dealers, regardless of the size of their business, the losses from bad bills were small. Through the use of the ticket system a large part of the retail business was done on advance payments.

It is noteworthy that only the larger dealers had expenses listed under the item of advertising. Practically all the dealers had expenses which may have been properly listed under that item, but were listed under either administrative or miscellaneous expenses. Besides the readily recognized expenses of advertising, practically all the dealers made contributions or gifts of various kinds to gain or retain the good will of consumers. The comparatively expensive delivery equipment of the larger dealers also has a certain advertising value, although such expenses are not listed under that item.

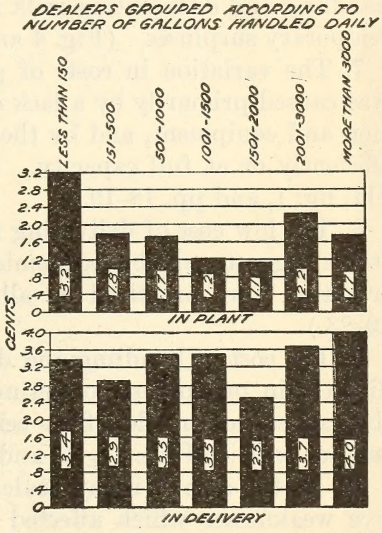

FIG. 13.—Variations in cost of labor per gallon.

In this connection it is important to note the lack of uniformity in provision made for the administrative end of the business, but in general the administrative expenses, which included office expenses, tended to increase in proportion to the size of the business. The smallest dealers had practically no administrative investments. See Table XVII.) Though the larger dealers generally had better administrative organizations, the personal supervision which the smaller ones were able to give to the business was an important factor in lowering their expenses.

CONCLUSIONS.

1. The demands for market milk in Detroit necessitated arrangements for obtaining a supply from farmers living too far from the city to effect an economical distribution of their comparatively small production. (Fig. 1 and pp. 2–4.)

2. The prices paid to farmers by the various dealers competing with one another in the market milk business of the city varied considerably. Milk dealers as well as the farmers were dissatisfied with conditions then existing. (Figs. 2 and 3 and pp. 4–7.)

3. A lack of standardization in the construction and equipment of country milk stations contributed largely to the varying costs of handling milk in the country. (Pl. I and pp. 8–10.)

4. Because they owned the country milk stations the larger dealers were able to obtain milk more cheaply in relatively distant areas of production. (Pl. I and pp. 12–14.)

5. Inconvenient train schedules, lack of satisfactory refrigeration facilities, and comparatively high transportation rates prevented some dealers from obtaining a supply of milk from certain areas of production. (Fig. 1; Pl. I, fig. 1; Pl. II, fig. 1, and pp. 3, 11–14.)

6. The fluctuating daily demands for market milk and its various derivatives in the city necessitate the use of proper equipment for handling and distributing milk and for the economical utilization of temporary surpluses (Fig. 4 and pp. 14–16.)

7. The variation in costs of preparing milk for city distribution was caused primarily by a lack of standardization in plant construction and equipment, and by the fact that some plants were not run efficiently or at full capacity. (Figs. 11 and 12; Pl. II, fig. 2; Pl. III, fig. 1, and pp. 18–19.)

8. The low cost of delivering milk in wholesale quantities to retail stores suggests possible economies by dealers if such a system of distribution were practiced by all. (Fig. 9; Pl. III, fig. 2, and pp. 19–23.)

9. The cost of handling and distributing in the city does not vary directly in proportion to the number of gallons handled, although the larger dealers do effect certain economies not possible to the smaller ones. (Figs. 11, 12, and 13 and pp. 23–27.)

10. In the case of many dealers there was evidence of administrative weaknesses which affected not only the internal economies of the business but also the relations of the business with producers and consumers. (P. 27.)

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